STUDY OF DEWETTING IN THIN POLYMER FILMS

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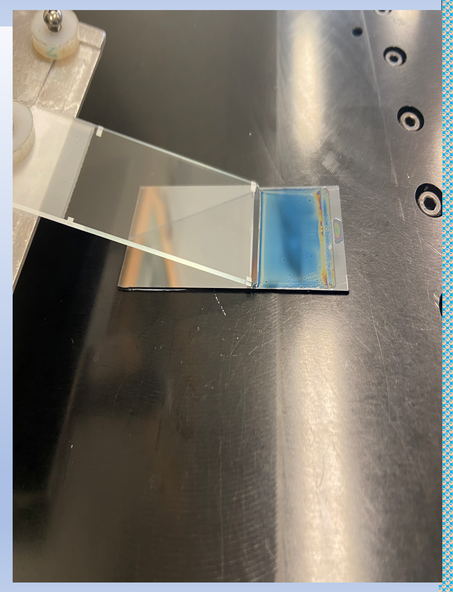
BACKGROUND / INTRODUCTION

- Dewetting is a phenomenon that occurs at the solid-liquid interface where the liquid retracts from the non-wettable solid it was forced to cover
- This process can be observed in macroscale but is taken to microscale (polymer films) to observe various interesting mechanisms at different processing temperatures and timescales
- The polymer film is used to study the various stages of Dewetting at and above the Glass Transition temperature with the help of an Optical Microscope
- By controlling parameters such as time, temperature, etc. controlled dewetted structures can be obtained on a variety of substrates which are useful for templating nanoparticles as well as in lithography applications

OVERVIEW OF THE EXPERIMENT

- PolyStyrene (2k) – 20mg is taken into a 2ml vial and Toluene-1ml is then added in order to prepare a 2% (wt/V) solution
- The solution is then filtered using a 0.2 µm filter
- The silicon substrate is pre cleaned with Toluene and placed in UV-Ozone system to remove any impurities and etch any unwanted oxides
- A procedure named Flow coating is used to make the polymer film

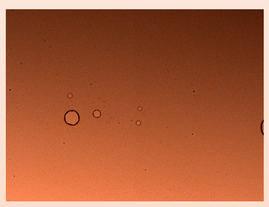


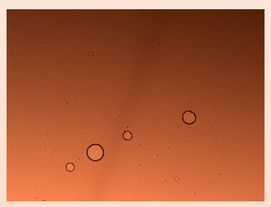
RESULTS FROM THE TESTS

- Polymer film annealed at 70^{o}C (glass transition temperature) for 5 mins under 30 psig vacuum

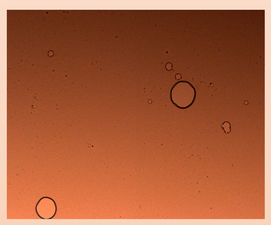
Note: All the images are scaled to 50µm

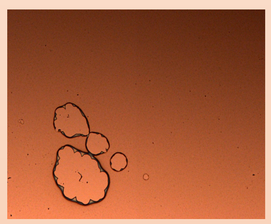
- 80^{o}C for 5 mins under 30 psig vacuum



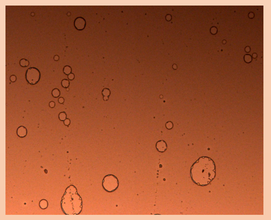


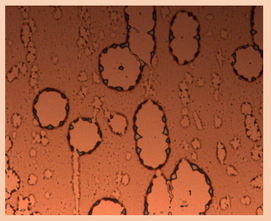
- 80^{o}C for 10 mins under 30 psig vacuum



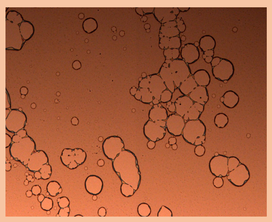


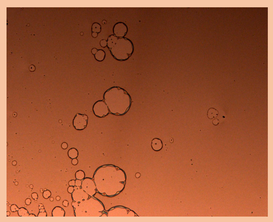
- 90^{o}C for 5 mins under 30 psig vacuum



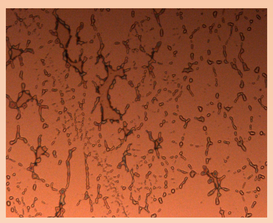


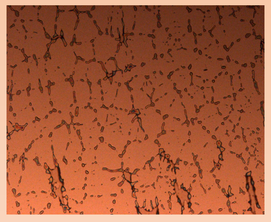
- 90^{o}C for 10 mins under 30 psig vacuum





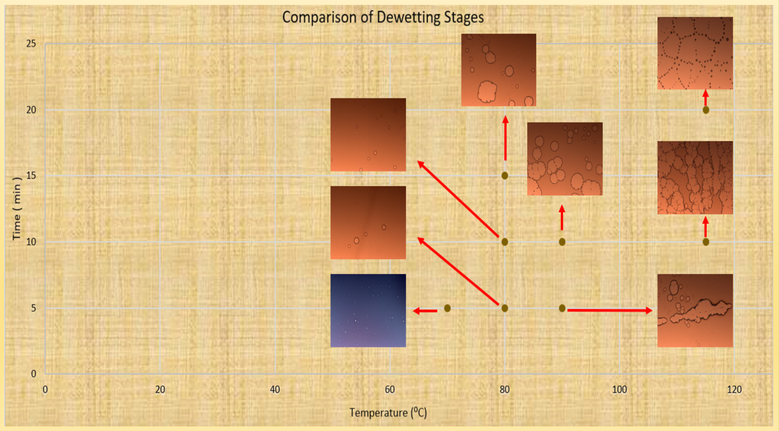
- 115^{o}C for 10 mins under 30 psig vacuum





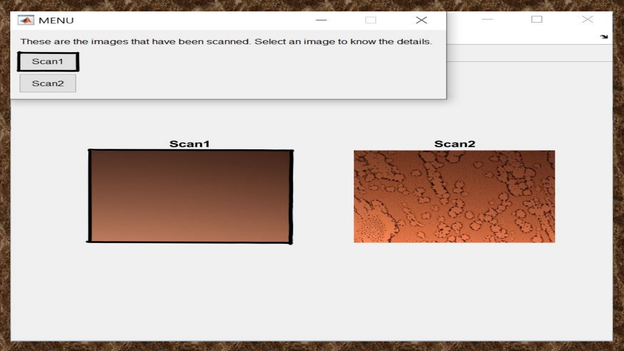
ANALYSIS OF THE SCANS

The representative images of various stages have been displayed on a Temperature-time graph to understand dewetting behavior with change in the parameters

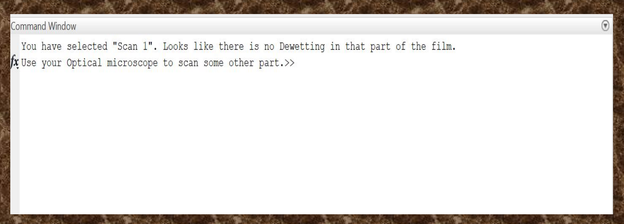


FUTURE WORK

- Software will have the necessary code to evaluate dewetting images for automatic recognition to describe the dewetting stage i.e. temperature and time
- Upon scanning the film at different locations, MATLAB will receive the data



- For example, on selecting “Scan 1”, MATLAB will give the following command.



ACKNOWLEDGEMENTS

I would like to extend my gratitude to Dr.Alamgir Karim for funding and guiding me throughout the Project. I am also grateful to the Graduate students in the lab for their willingness to advice me to overcome several challenges